

CLAIMS

What is claimed is:

1. A method of producing an undrawn yarn having a predetermined crystallinity, comprising:
5 extruding a molten polymer through a spinneret plate to form a plurality of filaments;
and
passing the plurality of filaments through a heated sleeve to thereby provide a quench delay, and taking up the plurality of filaments at a take-up speed;
wherein the quench delay and the take-up speed are selected such that an ultimate
10 elongation of the undrawn yarn increases at the predetermined crystallinity
when the quench delay increases.
2. The method of claim 1 wherein the predetermined crystallinity is between 10% and 40%, and wherein the undrawn yarn has a linear density of at least 300 dtex.
3. The method of claim 2 wherein the polymer comprises poly(ethylene terephthalate).
- 15 4. The method of claim 1 wherein the quench delay in the heated sleeve is increased by increasing a length of the heated sleeve.
5. The method of claim 1 wherein the length of the sleeve is at least 300 mm.
6. The method of claim 1 wherein the quench delay in the heated sleeve is increased by increasing a temperature in the heated sleeve.
- 20 7. The method of claim 1 wherein the take-up speed for the plurality of filaments is at least 3000 m/min.
8. A method of producing an undrawn yarn, comprising extruding a molten polymer through a spinneret plate to form a plurality of filaments, delaying quenching of the plurality of filaments in a heated sleeve, and taking up the plurality of filaments at a
25 take-up speed TU (m/min) using a quench delay such that the crystallinity of the undrawn yarn is less than $0.017 \times TU - 39$.

9. The method of claim 8 wherein the polymer comprises a polyester, and wherein the yarn has a linear density of at least 300 dtex.
10. The method of claim 8 wherein the heated sleeve has a length of at least 300 mm and wherein a temperature in the heated sleeve is at least 250 °C.
- 5 11. The method of claim 8 wherein the take-up speed is between 3000 m/min and 5000 m/min.
12. The method of claim 8 further comprising drawing the plurality of filaments after taking up to form a drawn yarn.
13. The method of claim 12 further comprising providing an overfinish to the drawn yarn.
- 10 14. The method of claim 13 further comprising at least partially enclosing the overfinished drawn yarn in a rubber-containing composition.
15. An undrawn delayed-quenched dimensionally stable polyester yarn having a crystallinity C, and an ultimate elongation UE, wherein $UE \geq -1.6 \cdot C + 121$.
- 15 16. The undrawn dimensionally stable polyester yarn of claim 15 wherein the polyester comprises poly(ethylene terephthalate).
17. The undrawn yarn of claim 15 wherein the crystallinity is between 10% and 40%.
18. The undrawn yarn of claim 17 wherein the linear density is between 300 and 6000 dtex.
19. A drawn dimensionally stable yarn formed from the undrawn dimensionally stable polyester yarn of claim 15.
- 20 20. A product comprising the drawn dimensionally stable yarn of claim 19.
21. The product of claim 20, wherein the product is selected from the group consisting of a power transmission belt, a conveyor belt, an automobile tire, a safety belt, a parachute harnesses, a parachute line, a cargo handling net, and a safety net.

22. An apparatus comprising:
- a spinneret plate operationally coupled to an extruder, that provides a molten polymer to the spinneret plate, wherein the spinneret plate produces a plurality of filaments from the molten polymer;
- 5 a heated sleeve that receives the plurality of filaments, thereby delaying quenching at a predetermined quench delay; and
- a take-up roll that takes up the plurality of filaments at a take-up speed, wherein the take-up speed and the heated sleeve are configured to operate at a condition in which ultimate elongation of a yarn having a predetermined crystallinity
- 10 increases when the predetermined quench delay increases.
23. The apparatus of claim 22 wherein the molten polymer comprises a polyester and wherein the spinneret plate comprises at least 50 orifices that produce the plurality of filaments.
24. The apparatus of claim 22 wherein the heated sleeve has a length of at least 300 mm
- 15 and wherein the heated sleeve has a temperature of at least 250 °C.
25. The apparatus of claim 22 wherein the take-up speed is between 3000 m/min and 5000 m/min.